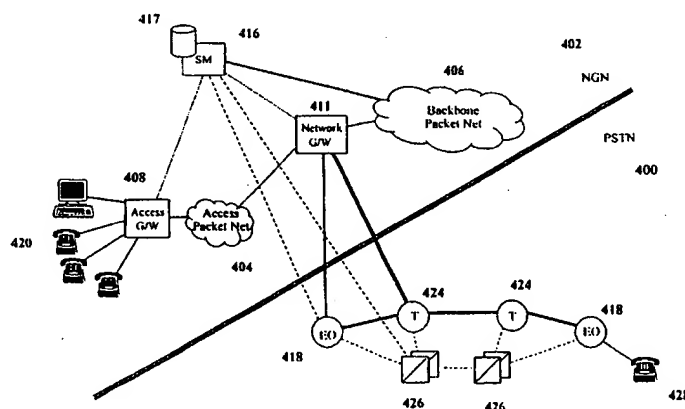




## INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification <sup>7</sup> : H04L 12/66, H04J 3/12, H04M 11/00		A1	(11) International Publication Number: WO 00/35157
			(43) International Publication Date: 15 June 2000 (15.06.00)
(21) International Application Number: PCT/US99/29099			(81) Designated States: CA, JP, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).
(22) International Filing Date: 8 December 1999 (08.12.99)			
(30) Priority Data: 60/111,505 8 December 1998 (08.12.98) US			
(71) Applicant: TELCORDIA TECHNOLOGIES, INC. [US/US]; 445 South Street Room 1G112R, Morristown, NJ 07960 (US).			
(72) Inventor: SMYK, Darek; 15 Zirkel Avenue, Piscataway, NJ 08854 (US).			
(74) Agents: GIORDANO, Joseph et al.; c/o International Coordinator, Telcordia Technologies, Inc., 445 South Street Room 1G112R, Morristown, NJ 07960-6438 (US).			<b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: **SYSTEM AND METHOD FOR GRADUAL TRANSITION OF LOCAL PHONE SERVICES FROM PSTN TO NEXT GENERATION NETWORK**



## (57) Abstract

For any telephone service subscriber, local services could be offered based on either the packet switched next generation network NGN (402) or the PSTN network (400). The network can be configured such that for each particular phone line, the line's services are based either on a PSTN's class 5 switch (418) or on an NGN's service manager SM (416). The local service provider, through software reconfiguration could quickly and efficiently move service subscribers' phone lines from class 5 switch (418) based local services to SM (416) based services, and vice-versa. If a call origination is attempted from a phone connected to an access gateway, the SM (416) will instruct the network to handle the call differently depending on whether the services should be offered based on the class 5 switch (418) or the SM (416). If the services ought to be offered through the class 5 switch (418), then the SM (416) will establish a virtual local loop connection between the phone and the class 5 switch (418). Subsequently, the class 5 switch (418) will provide the dial tone, collect the dialed digits and proceed with establishing the call. The NGN simulates a traditional local loop. If the local services are offered for the customer through the SM (416), the SM (416) will fully control the call establishment and route the call bypassing the class 5 switch (418).

**FOR THE PURPOSES OF INFORMATION ONLY**

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AL	Albania	ES	Spain	LS	Lesotho	SI	Slovenia
AM	Armenia	FI	Finland	LT	Lithuania	SK	Slovakia
AT	Austria	FR	France	LU	Luxembourg	SN	Senegal
AU	Australia	GA	Gabon	LV	Latvia	SZ	Swaziland
AZ	Azerbaijan	GB	United Kingdom	MC	Monaco	TD	Chad
BA	Bosnia and Herzegovina	GE	Georgia	MD	Republic of Moldova	TG	Togo
BB	Barbados	GH	Ghana	MG	Madagascar	TJ	Tajikistan
BE	Belgium	GN	Guinea	MK	The former Yugoslav Republic of Macedonia	TM	Turkmenistan
BF	Burkina Faso	GR	Greece			TR	Turkey
BG	Bulgaria	HU	Hungary	ML	Mali	TT	Trinidad and Tobago
BJ	Benin	IE	Ireland	MN	Mongolia	UA	Ukraine
BR	Brazil	IL	Israel	MR	Mauritania	UG	Uganda
BY	Belarus	IS	Iceland	MW	Malawi	US	United States of America
CA	Canada	IT	Italy	MX	Mexico	UZ	Uzbekistan
CF	Central African Republic	JP	Japan	NE	Niger	VN	Viet Nam
CG	Congo	KE	Kenya	NL	Netherlands	YU	Yugoslavia
CH	Switzerland	KG	Kyrgyzstan	NO	Norway	ZW	Zimbabwe
CI	Côte d'Ivoire	KP	Democratic People's Republic of Korea	NZ	New Zealand		
CM	Cameroon			PL	Poland		
CN	China	KR	Republic of Korea	PT	Portugal		
CU	Cuba	KZ	Kazakistan	RO	Romania		
CZ	Czech Republic	LC	Saint Lucia	RU	Russian Federation		
DE	Germany	LI	Liechtenstein	SD	Sudan		
DK	Denmark	LK	Sri Lanka	SE	Sweden		
EE	Estonia	LR	Liberia	SG	Singapore		

**SYSTEM AND METHOD FOR GRADUAL TRANSITION OF LOCAL PHONE  
SERVICES FROM PSTN TO NEXT GENERATION NETWORK**

**CROSS-REFERENCE TO RELATED APPLICATION**

5           This application claims the benefit of U.S. Provisional Application No.  
60/111,505, filed December 8, 1998.

**FIELD OF THE INVENTION**

          This invention relates to the provision of local telephone services.

10

**BACKGROUND**

          The telecommunications industry is currently undergoing a transformation from a traditional circuit switched based PSTN network, which was originally designed and optimized for carrying voice telephony traffic, to packet based networks which will be capable of efficiently supporting both voice and data communications. A next generation network (NGN) is a packet-based network that employs new control, management, and signaling techniques to provide both narrow-band voice telephony services and broadband, multimedia services. NGNs are able to satisfy a user's need for higher bandwidth while allowing service providers to offer innovative services, enabling new services and revenue streams, and reducing management costs and time to market.

          A generalized local service provider NGN architecture is shown in Figure 1. It consists of two sub networks, a PSTN **100** and an integrated voice and data packet network **102**. The packet network is further divided into access networks **104** and a backbone network **106**. The access packet network **104** physically connects subscribers **120** to the local service provider network. In the case of residential customers, the access network **104** will typically be based on digital subscriber loop (xDSL) technology deployed in the local loop or MSCNS DOCSIS technology deployed over coax cable. On the customer side, the access network **104** terminates on the customer premises device, which is called here the access gateway **108**. The particular implementation of an access gateway depends on the technology utilized in the access network. For access networks utilizing xDSL technology, the access gateway **108** may include an xDSL modem. For a hybrid fiber-coax based access network, the access gateway **108** may be merged with set top boxes traditionally utilized for receiving TV signals broadcasted from

cable-based distribution plants. Traditional telephone sets are either directly connected to the access gateway **108** or they are connected via a more elaborate home area network.

5 The packet based backbone network **106** is optimized for efficiently transmitting large amounts of data and typically utilizes IP, ATM and/or SONET technologies. For example, in the initial network deployment stages, the access and backbone networks could utilize ATM technology. However, since ATM switched virtual circuit (SVC) technology is not mature and ubiquitous enough to deploy end-to-end in the packet network, private virtual circuits (PVCs) are used in the access network and, frequently, in  
10 the backbone network.

The access network **104** is connected to the backbone network **106** via backbone gateways **110**, which bridge transport technologies utilized in the two networks. For example, in the case of a xDSL based access network the backbone gateway **110** includes digital subscriber loop access multiplexer (DSLAM) functionality.  
15 Calls spanning the packet network and PSTN network, such as calls originating from access gateways **108** and terminating on the PSTN or vice versa, are routed through trunking gateways **112**. A signaling gateway **114** is responsible for receiving signaling information from the PSTN (e.g., signaling system 7 packets) and routing that information to the appropriate network elements in the NGN. The signaling gateway can  
20 be a separate component or can be integrated into a service manager (SM) **116**.

The NGN has its own control infrastructure. Typically, network elements are designated to support service, session and connection signaling. In this document, these elements are called service managers (SMs) but depending on the protocols involved, these elements are also called media gateway controllers, call agents, gatekeepers, and  
25 signaling agents.

Local service providers have started the transition of their networks from the traditional PSTN infrastructure to an NGN architecture to offer both local and long distance services. The challenge for the NGN network equipment vendors will be to support graceful transition of the current local service subscribers to the new  
30 infrastructure.

A serious limitation of the NGN architecture of Figure 1 is that it does not support graceful migration of local services from the existing circuit switched infrastructure to the NGN network. In this architecture, the NGN network must provide all local services for phones utilizing packetized voice in the local loop. In addition, once a particular line is

provisioned to receive local services from NGN, there is no easy and inexpensive way of re-provisioning the line to utilize PSTN local services.

Furthermore implementing within the NGN network all of the local services that are currently available in the PSTN is not a trivial task. Class 5 switches providing local  
5 PSTN services have been evolving for decades and by some estimates currently support over 500 different local service features. It is not reasonable to expect that all these features will be totally replicated in the new NGN infrastructure within a short timeframe. However, if NGN supports only a small subset of the local features then the deployment of the NGN may be limited to a small number of very specific target  
10 customers. Success of the NGN deployment will then depend on the reliability of the prognosis that can be made for defining a limited set of features to satisfy the needs of targeted customers until the NGN network matures. These deployment limitations could hamper the growth of the NGN network.

Prior techniques to address the migration of PSTN to NGN have certain  
15 limitations. Figure 2 illustrates a specific implementation of the general NGN architecture depicted in Figure 1. In this xDSL-based architecture, local service features for some telephones **222** are implemented by a class 5 end office switch **218**. For other telephones **220**, local service features are implemented based on the NGN service control infrastructure (i.e. based on the SM **216** network component).

20 For each set of telephone lines multiplexed over a single xDSL equipped local loop, the phone **222** utilizing analog transmission uses the bottom 4 KHz of the frequency spectrum of the access loop. The media stream for this line is separated in the DSLAM **209** and connected to the line side of the class 5 switch **218**. For the remaining phones **220**, voice communication is implemented by transmitting packetized  
25 voice stream over the upper portion of the frequency spectrum. The packetized voice stream is routed via the DSLAM **209** and the network gateways **211**. The SM **206** controls local service features for telephones utilizing packetized voice.

While a limited number of lines are able to access local services provided by a class 5 switch in this architecture, these lines are unable to access any innovative  
30 features provided by the NGN. In addition, no easy or cost effective way exists to re-provision a line for a packetized voice customer who wishes to utilize services offered only on a class 5 switch.

Figure 3a illustrates a network architecture that provides users access to class 5 switch features and an NGN architecture for transport. Phones **322** use traditional local

loop facilities to connect to a class 5 switch **318**. In this architecture, the class 5 switch **318** connects to an NGN network **303** via a packet data interface **319** located at the switch **318**. While this architecture provides a service provider with access to some of the bandwidth and cost reduction benefits of the NGN, customers are not able to access innovative features offered by the NGN.

This architecture is sometimes modified to include packetized local loops as illustrated Figure 3b. Virtual phones **320** use packetized local loop facilities (e.g., DSL) to connect to a local loop gateway **309**. The packetized local loop network communicates with a class 5 switch **318** using traditional local loop signaling (e.g., channel associated signaling) through a local loop gateway **309**. In this architecture, the class 5 switch **318** connects to an NGN network **303** via a packet data interface **319** located at the switch **318**. This architecture has the benefit of providing multiple virtual phone lines over a single physical line. However, customers are not able to access the innovative features offered by the NGN.

An objective of my invention is to provide a network architecture that will allow local service providers to gracefully migrate local service features to the NGN network. This will include providing ability to efficiently switch local lines from the NGN to PSTN local service infrastructures and vice-versa.

It is yet another objective of my invention to enable supporting network infrastructure transparency to service subscribers and to reduce the local service provider's risk associated with abruptly replacing one network infrastructure with another.

## SUMMARY

My invention is directed to a system which allows providers of packet based networks such as NGNs to offer customers the choice of local services provided by switches in the PSTN or services provided by an SM in the NGN. In a specific embodiment of my invention, the system includes an access gateway providing analog or digital access to the NGN, an SM identifying selected mode of operation for the customer and providing control of local services offered by the NGN, a subscriber database storing customer service preferences, a network gateway providing an interface between the NGN and the PSTN, a class 5 end office including digital loop carrier support, and PSTN access tandem switches. The system can operate in two separate modes simultaneously.

In the first mode of operation, the NGN simulates a digital local loop to allow local services to be offered to NGN customers by class 5 switching systems. In this mode, the NGN is transparent to both the customer and the class 5 switching system. This mode of operation is referred to herein as virtual local loop (VLL) mode. In this mode, the SM is notified of a call origination or call termination event. The SM accesses the subscriber database to determine whether the customer subscribes to services offered through the NGN or through the class 5 switch. If the customer subscribes to services offered through the class 5 switch, the packet based network under control of the SM establishes a connection between the network customer and the network gateway through an access gateway. A connection is also established between the network gateway and the class 5 switch. After these connections are established, local loop supervision information is signaled between the packet based network and the class 5 switch using digital loop carrier channel associated signaling. The customer is then connected via the virtual local loop to the class 5 end office which acts as an originating end office for the customer's line.

Alternatively, the VLL mode of operation could be implemented in another manner. In this implementation, the local loop supervision information is signaled via a combination of channel associated signaling and out-of-band signaling. In this mode, the loop supervision signaling between the class 5 switch and network gateway is via channel associated signaling. The signaling between the network gateway and the SM and between the SM and access gateway is via out-of-band signaling. In this mode, the network gateway translates the channel associated signaling into out-of-band signaling messages.

In a second mode of operation, the NGN simulates a local loop to allow local services to be offered to NGN customers through the SM in the NGN. In this embodiment, the NGN is transparent to the customer. This mode of operation is referred to herein as native NGN mode.

The access gateway is continually monitoring to detect a call origination event on a customer's line. When a call event is detected for the customer's line, the access gateway sends a message reporting the event to the SM.

Based on the information in the subscription database, the SM determines that the customer has selected service features offered through the SM and the call should be established in native NGN mode. In native NGN mode, the SM sends a message to the access gateway requesting that the gateway provide dial tone and collect the dialed

digits according to the dialed plan specified in the message. The access gateway provides a dial tone, collects the dialed digits and reports the dialed number to the SM and the SM immediately acknowledges that notification. The call to the dialed number is then established.

5

### BRIEF DESCRIPTION OF DRAWINGS

Figure 1 is a network diagram illustrating a general network deployment of a next  
10 generation network.

Figure 2 is a network diagram illustrating a specific implementation of a next generation network.

Figure 3 is a network diagram illustrating a method of providing local services via the PSTN and transport service via a packet based network.

15 Figure 4 is a functional network diagram according to the present invention.

### DESCRIPTION

Figure 4 illustrates a system according to a specific illustrative embodiment of my invention. In this architecture, for any telephone service subscriber **420**, local services  
20 could be offered based on either the packet switched NGN **402** or the PSTN network **400**. The network can be configured such that for each particular virtual phone line, the line's services are either based on a PSTN's class 5 switch **418** or on a NGN's SM **416**. The local service provider, through software reconfiguration, could quickly and efficiently move service subscribers' virtual phone lines from class 5 switch based local services to  
25 SM based services, and vice-versa. The system can operate in two separate modes simultaneously.

In the present invention, the SM **416** controls whether the local services are offered through the SM or through the class 5 switch **418**. For example, if a call origination is attempted from a phone **420** connected to an access gateway **408**, the SM  
30 **416** will instruct the network to handle the call differently depending on whether the services should be offered based on the class 5 switch or the SM. If the services ought to be offered through the class 5 switch, then the SM **416** will establish a connection between the phone **420** and the class 5 switch **418**. Subsequently, the class 5 switch



**418** will provide the dial tone, collect the dialed digits and proceed with establishing the call. The NGN in accordance with an aspect of my invention simulates a traditional local loop. However, if the local services ought to be offered through the SM, the SM **416** will fully control the call establishment and route the call bypassing the class 5 switch **418**.

5        In a first mode of operation of my invention depicted in Figure 4, the NGN **402** thus simulates a local loop to allow local services to be offered to NGN customers by class 5 switching systems. In this mode, the NGN is transparent to both the customer and the class 5 switching system. This mode of operation is referred to herein as virtual local loop (VLL) mode.

10        The access gateway **408** is continually monitoring to detect a call origination event on a customer's line **420**. In this mode of operation, a call originating from an NGN customer can be delivered to an off-network party, as described below. When an off-hook event is detected by the access gateway **408**, the access gateway sends a message reporting the event to the SM **416**. The SM **416** immediately sends an  
15        acknowledgement message back to the access gateway **408**. In a preferred embodiment of the invention, the signaling between the access gateway and the SM is media gateway control protocol (MGCP) or its successor (i.e., H.248).

20        A subscription database **417** contains information related to the customer's line such as whether the customer subscribes to communications services offered through the SM or through the class 5 switch. The subscription database **417**, accessible by the SM, may be resident on the SM or may be located on another platform within the NGN or external to the NGN.

25        Based on the information in the subscription database **417**, the SM **416** determines that the customer has selected service features offered through the class 5 switch **418** and the call should be established in VLL mode. The subscription database may also contain information indicating that the customer has selected service features offered by the NGN. This mode of operation is referred to herein as native NGN mode. Native NGN mode is described in detail below.

30        The SM **416** sends a message to the access gateway **408** requesting the gateway to seize a connection to the network gateway **411**. If ATM is deployed in the access network **404**, the access gateway **408** will seize a private virtual circuit (PVC) channel. A network provider may also choose to deploy IP in the access network. Within the same message, the SM **416** requests that the access gateway **408** monitor for an on-hook transition by the customer.

The access gateway **408** seizes a connection to the network gateway **411** and connects it to the endpoint originating the call. The access gateway then sends an acknowledgment message back to the SM **416** including the session description, used to describe the audio properties for the connection. The session description information  
5 includes the address at which the access gateway **408** is ready to receive audio data.

The SM **416** sends a set-up message using channel associated signaling to the line termination side of the class 5 switch **418** through the network gateway **411**. The channel associated signaling used between the SM and the class 5 switch is based on the signaling described in GR-303, *Integrated Digital Loop Carrier System Generic*  
10 *Requirements, Objectives, and Interface* (Telcordia Technologies, 1998). By using traditional local loop signaling, the NGN simulates a local loop and its involvement in the call is transparent to the class 5 switch. The set-up message from the SM **416** requests that the class 5 switch **418** begin assignment of the time slot on the time multiplexed bearer channel between the network gateway **411** and the switch **418**. The call  
15 reference information element of the setup message identifies the telephone line originating the call setup.

The class 5 switch **418** signals to the network gateway **411** the assigned time slot for the call and that the time slot is connected to the appropriate line unit of the class 5 switch **418**. The channel identification element of the message to the network gateway  
20 identifies which DS0 (time slot) to use for the originating call. In addition, the network gateway **411** forwards the message to SM **416**.

The SM **416** sends a message to the network gateway **411** requesting that the network gateway cross connect the DS0 (time slot) identified by the class 5 switch and the connection chosen by the access gateway **408**. The network gateway **411**  
25 acknowledges this request in a message to the SM **416**.

The SM **416** sends signals to the class 5 switch **418** that the appropriate bearer circuit was connected to the timeslot and that the line equipment will be inserting and reacting to ABCD codes provided in the channel associated signaling. The SM **416** also signals to the network gateway **411** requesting that the gateway start inserting off-hook  
30 ABCD signaling bits. The network gateway **411** sends an acknowledgment message for this request to the SM **416** and starts inserting off-hook ABCD signaling bits.

The class 5 switch **418** and the access gateway **408** proceed in establishment of the call without any further involvement from the SM **416**. At this point, the call proceeds as a normal PSTN call using services offered through the class 5 switch such as

traditional telephony services and AIN services. The class 5 switch will provide dial tone to the customer **420** and collect dialed digits. The call is routed to the terminating party using traditional PSTN signaling and transmission capabilities.

Upon detection of an on-hook event (i.e., off-network or terminating party hangs up) by the PSTN, the originating class 5 switch sends a disconnect message to the SM **416**. The message signals to the SM to begin clearing the time-slot assignment. The SM **416** sends a delete connection message to the access gateway **408**. At the same time, the SM **416** also requests that the access gateway **408** monitor for subsequent call originations from the line. The access gateway responds to the delete connection message with an acknowledgment including terminating call parameters.

The SM **416** next signals the network gateway **411** to delete the cross connect between the DS0 (time slot) and the connection established by the access gateway **408**. The network gateway responds to the message from the SM with an acknowledgment message.

The SM **416** sends a release message to the class 5 switch **418** through the network gateway **411**. The class 5 switch **418** sends a release complete message to the SM **416** indicating that the call termination procedure was fully completed.

In the embodiment of my invention depicted in Figure 4, a call from an off-network party can also be delivered in VLL mode to an NGN customer **420**. A call from an off-network provider terminates on a class 5 switch **418**. This method of termination provides NGN customers access to terminating switched-based features (e.g., call forwarding) and intelligent network features. The class 5 switch **418** sends a set-up message over the line-side connection to the SM **416** when a call is placed to an NGN service subscriber **420**. The set-up message includes a channel identification element, which specifies the DS0 (time slot) to be used for the call.

Based on the information in the subscription database, the SM **416** confirms that the call to the called party ought to be established in VLL mode. It sends a message to the access gateway **408** requesting that the gateway create a connection to the network gateway **411**. Within this same message, the SM **416** request that the access gateway monitor for an on-hook transition.

The access gateway **408** seizes a connection to the network gateway **411** and connects it to the endpoint originating the call. The access gateway then sends an acknowledgment message back to the SM **416** including the session description, used to

describe the audio properties for the connection. The session description information includes the address at which the access gateway **408** is ready to receive audio data.

The SM **416** sends a message to the network gateway **411** requesting that the network gateway cross connect the DS0 (time slot) identified by the class 5 switch and  
5 the connection chosen by the access gateway **408**. The network gateway **411** acknowledges this request in a message to the SM **416**.

The SM **416** sends signals to the class 5 switch **418** that the appropriate bearer circuit was connected to the timeslot and that the line equipment will be inserting and reacting to ABCD codes provided in the channel associated signaling. The message  
10 also include channel identification information so that the class 5 switch can verify that the SM has used the correct DS0 (time slot) for the incoming call. The SM **416** also signals to the network gateway **411** requesting that the gateway start inserting on-hook ABCD signaling bits. The network gateway **411** sends an acknowledgment message for this request to the SM **416** and starts inserting on-hook ABCD signaling bits.

15 The class 5 office **418** then starts inserting ringing ABCD signaling bits. In response, the network gateway **411** sends a message to the SM **416** reporting the ringing signaling bit. The SM **416** sends an acknowledgment message to the network gateway **411**.

The SM **416** sends a message to the access gateway requesting that the  
20 gateway start ringing the phone **420** and monitoring for off-hook event and the access gateway sends an acknowledgment message to the SM **416**. When the off-hook event is detected, the access gateway **408** reports the event to the SM **416** and the SM sends an acknowledgment message back to the access gateway.

The SM **416** signals to the network gateway **411** requesting that the gateway  
25 start inserting off-hook ABCD signaling bits. The network gateway **411** sends an acknowledgment message for this request to the SM **416** and starts inserting off-hook ABCD signaling bits.

The class 5 switch **418** starts inserting normal supervision ABCD signaling bits. The class 5 switch **418** and the access gateway **408** proceed in establishing the call  
30 without any further involvement from the SM **416**.

In another mode of operation of my invention where the NGN **402** thus simulates a local loop to allow local services to be offered to NGN customers through the SM in the NGN. In this embodiment, the NGN is transparent to the customer. This mode of operation is referred to herein as native NGN mode.

The access gateway **408** is continually monitoring to detect a call origination event on a customer's line **420**. In this mode of operation, a call originating from an NGN customer can be delivered to an off-network party served by a PSTN, as described below. When an off-hook event is detected by the access gateway **508**, the access gateway sends a message reporting the event to the SM **416**. The SM **416** immediately sends an acknowledgement message back to the access gateway **408**. In a preferred embodiment of the invention, the signaling between the access gateway and the SM is MGCP or its successor (i.e., H.248).

Based on the information in the subscription database **417**, the SM **416** determines that the customer has selected service features offered through the SM **416** and the call should be established in native NGN mode. The SM **416** sends a message to the access gateway **408** requesting that the gateway provide dial tone and collect the dialed digits according to the dialed plan specified in the message. Within this same message, the SM **416** requests that the gateway **408** monitor for an on-hook transition. The access gateway **408** immediately sends an acknowledgement message to the SM **416**.

The access gateway provides a dial tone, collects the dialed digits and reports the dialed number to the SM and the SM immediately acknowledges that notification. The access gateway **408** seizes a connection to the network gateway **411** and connects it to the endpoint originating the call. The access gateway then sends an acknowledgment message back to the SM **416** including the session description, used to describe the audio properties for the connection. The session description information includes the address at which the access gateway **408** is ready to receive audio data. Based on the dialed number, the SM determines that the calls should be routed to the PSTN via the network gateway.

The SM **416** sends a message to the network gateway **411** requesting that the gateway seize the outgoing time division multiplexed (TDM) trunk to the trunk side of the access tandem **424**. The message contains identification of connection to be used for bearer connection between the network gateway **411** and the access gateway **408**. The network gateway **411** acknowledges the request by sending a message to the SM **416**.

The SM next sends a signaling system 7 initial address message (IAM) to the PSTN switch via the common channel signaling (CCS) signaling transfer point (STP) **426**. In a preferred embodiment, the NGN is connected to the access tandem in the PSTN through ISUP trunks for signaling. As the call progresses, the SM expects to

receive an address complete message (ACM) via the STP 426. This flow assumes the half-duplex transmission path is used to provide ringing from the remote switch (in the PSTN) to the calling party 420. After the called party 428 goes off-hook, the SM will receive an answer message (ANM) from the PSTN switch 418 via the STP 426.

5        Upon receipt of the answer message, the SM 416 sends a message to the access gateway 408 requesting it to place the connection in full duplex mode. The access gateway 408 immediately acknowledges that request and the call is established.

      When the calling party 420 goes on-hook, the access gateway 408 notifies the SM 416 and the SM acknowledges this notification. The SM 416 begins to tear down  
10    the call, releasing the facilities in parallel. As part of this procedure, the SM 416 sends a release message to the PSTN switch 418 via STP 426. The SM 416 also sends a message to the access gateway 408 instructing it to delete the connection and requesting notification of a subsequent off-hook event by the calling party. The acknowledgment message from the access gateway includes connection parameters.  
15    The SM 416 also instructs the network gateway 411 to release the TDM circuit connection and the network gateway acknowledges the request. The PSTN switch 418 also acknowledges the release message from the SM 416.

      Alternatively, the VLL mode of operation could be implemented in another manner. In this implementation, channel associated signaling is translated to MGCP  
20    signaling at the network gateway 411. Instead of inserting channel associated signaling into the packet stream of data, the access gateway 408 reports channel associated signals to the SM 416 as MGCP events. These events would then be forwarded (tunneled) by the SM to the network gateway 411 via the MGCP protocol and converted by the network gateway to channel associated signals used in the signaling to the class  
25    5 switch 418.

      For this architecture two additional MGCP events have to be handled by the SM: Power Ring and Flash Hook. Since the SM only has to forward these signals to their destinations (the access gateway or network gateway depending on the signal direction), the additional computational load introduced by these messages is minimal. Adopting  
30    such a scheme has an additional advantage if the transport used for bearer channels is other than AAL1 (common bit rate). In the case of AAL2 with voice compression and silence elimination, sending channel associated signals in the stream of data may be difficult. By using MGCP to report these events, bearer channel properties are irrelevant from a signaling point of view.

Note that to accommodate this mode of operation, the call flow described in connection with Figure 4 basically does not change (apart from the addition of the Power Ring MGCP message). The class 5 switch **418** will perform all computation intensive operations such as digit collection and call routing.

- 5     Although the invention has been shown and described with respect to exemplary embodiments thereof, it should be understood by those skilled in the art that various changes, omissions and additions may be made therein and thereto, without departing from the spirit and the scope of the invention.

**APPENDIX - ACRONYM LIST**

	<b>AAL</b>	ATM adaptation layer
	<b>ACM</b>	address complete message
5	<b>ANM</b>	answer message
	<b>ATM</b>	asynchronous transfer mode
	<b>CCS</b>	common channel signaling
	<b>DSL</b>	digital subscriber loop
	<b>IAM</b>	initial address message
10	<b>ISUP</b>	ISDN user part
	<b>NGN</b>	next generation network
	<b>MGCP</b>	media gateway control protocol
	<b>PSTN</b>	public switched telephone network
	<b>PVC</b>	private virtual circuit
15	<b>SM</b>	service manager
	<b>STP</b>	signaling transfer point
	<b>TDM</b>	time division multiplexed
	<b>VLL</b>	virtual local loop



## CLAIMS

I claim:

1. A method for using a packet based network as a telephone customer's local loop to enable packet based network customers to obtain communication services through either a packet based network or an end central office, said method comprising the steps of:
  - notifying a service manager in the packet based network of a call event;
  - accessing a subscriber database by the service manager to determine whether the packet based network customer subscribes to communication services through the packet based network or through the end central office;
  - establishing a local loop communication connection between the packet based network customer and a network element providing communication services; and
  - establishing a call between the packet based network customer and another party.
2. The method of claim 1 wherein said call event includes a call origination from the packet based network customer and a call termination event to the packet based network customer.
3. The method of claim 1 wherein the network element providing communication services includes the service manager and the end central office.
4. The method of claim 1 wherein said step of establishing the local loop communication connection for the packet based customer subscribing to communication services through the end central office further comprises the steps of:
  - establishing a connection between the packet network customer and a network gateway through an access gateway;
  - establishing a connection between the network gateway and the end central office; and
  - signaling local loop supervision information between the end central office and packet based network.
5. The method of claim 4 wherein the connection between the packet network customer and the network gateway through the access gateway includes asynchronous transfer mode circuits.
6. The method of claim 4 wherein the connection between the packet network customer and the network gateway through the access gateway includes IP circuits.

7. The method of claim 4 wherein the step of signaling local loop supervision information between the end central office and the packet based network comprises signaling via channel associated signaling.

8. The method of claim 7 wherein the channel associated signaling includes digital  
5 loop carrier hybrid signaling using ABCD signaling bits.

9. The method of claim 4 wherein the step of signaling local loop supervision information between the end central office and packet based network comprises the steps of:

signaling local loop supervision information between the end central office and  
10 the network gateway via channel associated signaling;

translating channel associated signaling to out-of-band signaling in the network gateway;

signaling local loop supervision information between the network gateway and the service manger via out-of-band associated signaling; and

15 signaling local loop supervision information between the service manager and the access manager via out-of-band signaling.

10. The method of claim 9 wherein the out-of-band signaling comprises media gateway control protocol signaling.

11. A method for using a packet based network as a telephone customer's local loop  
20 to enable packet based network customers to obtain communication services through an end central office, said method comprising the steps of:

notifying a service manager in the packet based network of a call event;

accessing a subscriber database by the service manager to determine whether  
the packet based network customer subscribes to communication services through the  
25 packet based network or through the end central office;

if the packet network customer subscribes to communications services through the end office,

establishing a connection between the packet network customer and a network gateway through an access gateway;

30 establishing a connection between the network gateway and the end central office; and

signaling local loop supervision information between the end central office and the packet based network; and.

establishing a call between the packet based network customer and another party.

12. The method of claim 11 wherein the connection between the packet network customer and the network gateway through the access gateway includes asynchronous transfer mode circuits.

13. The method of claim 11 wherein the connection between the packet network customer and the network gateway through the access gateway included IP circuits.

14. The method of claim 11 wherein the step of signaling local loop supervision information between the end central office and the packet based network further comprises signaling via channel associated signaling.

15. The method of claim 14 wherein the channel associated signaling includes digital loop carrier hybrid signaling using ABCD signaling bits.

16. The method of claim 11 wherein the step of signaling local loop supervision information between the end central office and packet based network further comprises the steps of:

signaling local loop supervision information between the end central office and the network gateway via channel associated signaling;

translating channel associated signaling to out-of-band signaling in the network gateway;

signaling local loop supervision information between the network gateway and the service manager via out-of-band associated signaling; and

signaling local loop supervision information between the service manager and the access manager via out-of-band signaling.

17. The method of claim 16 wherein the out-of-band signaling comprises media gateway control protocol signaling.

18. A method for using a packet based network as a telephone customer's local loop to enable packet based network customers to obtain communication services through a service manager, said method comprising the steps of:

notifying the service manager in the packet based network of a call event;

accessing a subscriber database by the service manager to determine whether the packet based network customer subscribes to communication services through the packet based network or through the end central office;

if the packet network customer subscribes to communications services through the service manager,

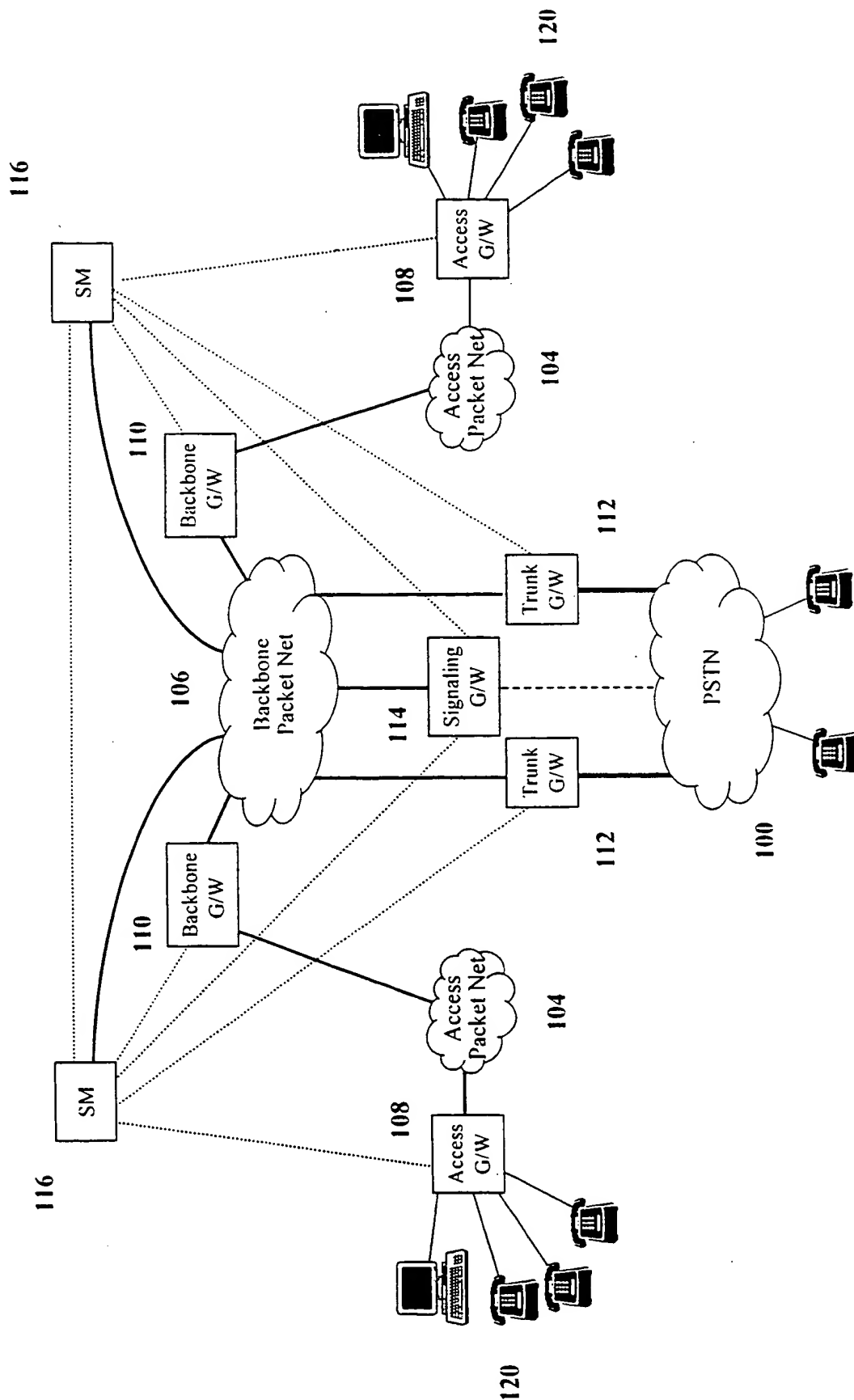
providing dial tone and collecting dialed digits at an access gateway; and  
sending a message including the dialed digits to the service manager from  
the access gateway; and

establishing a call between the packet based network customer and another  
5 party.

19. A system for establishing connections to a telephone network or to a packet  
based network for a telephone subscriber having packet based network access  
capabilities, said system comprising:

- an access gateway connected to said subscriber;
- 10 a subscription database containing information as to whether a subscriber is to  
be served through an end office in the telephone network or through the packet based  
network for a particular call;
- a service manager connected to said access gateway, said service manager  
providing access to said subscription database;
- 15 a network gateway connected to the telephone network and to the packet based  
network; and
- an access packet network connected between said access gateway and said  
network gateway for establishing a connection through the network gateway to either the  
telephone network or the packet based network under control of the service manager.
- 20 20. The system in accordance with claim 19 wherein said network gateway is  
connected both to the line termination side of the end office and to a tandem office in the  
telephone network, said service manager providing signaling to the line termination side  
of the end office through said network gateway.

Figure 1: Prior Art



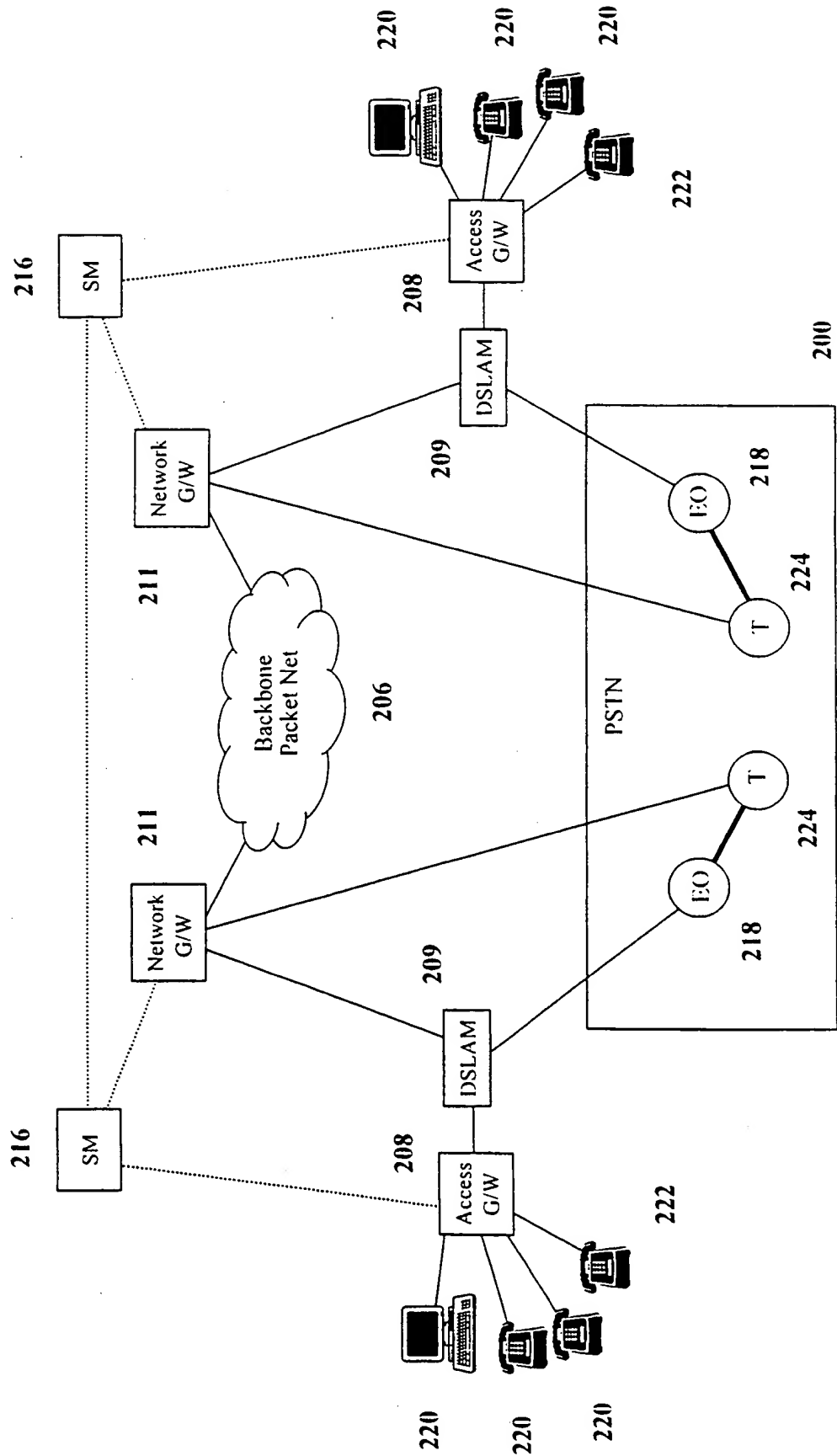


Figure 2: Prior Art

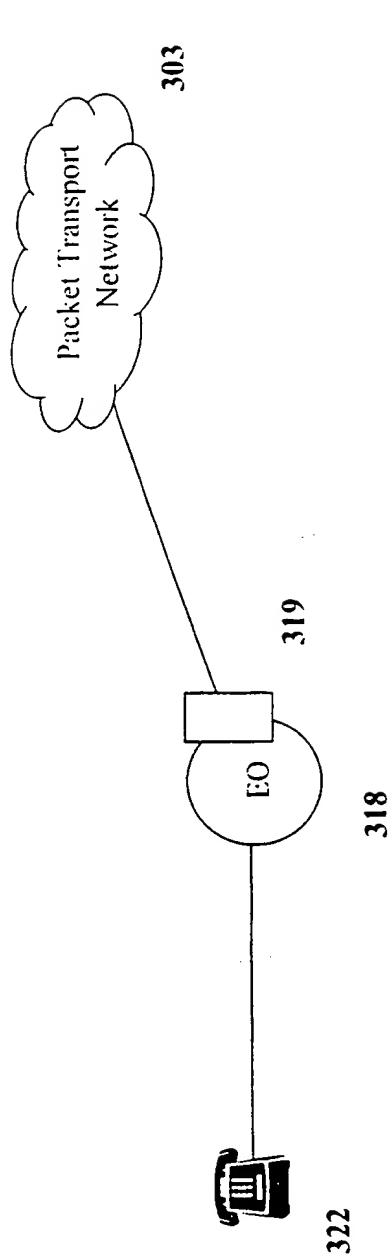


Figure 3a: Prior Art

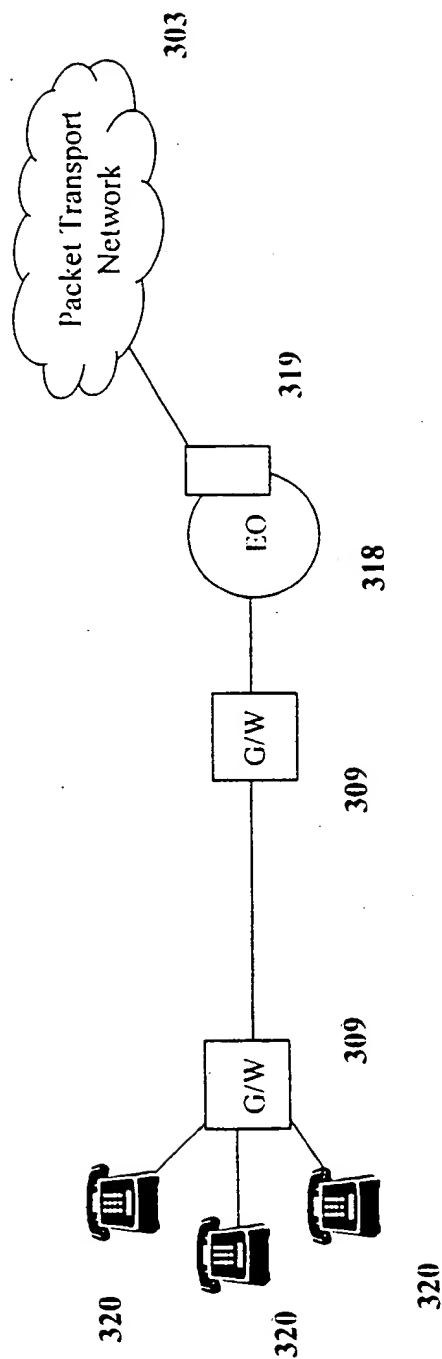


Figure 3b: Prior Art

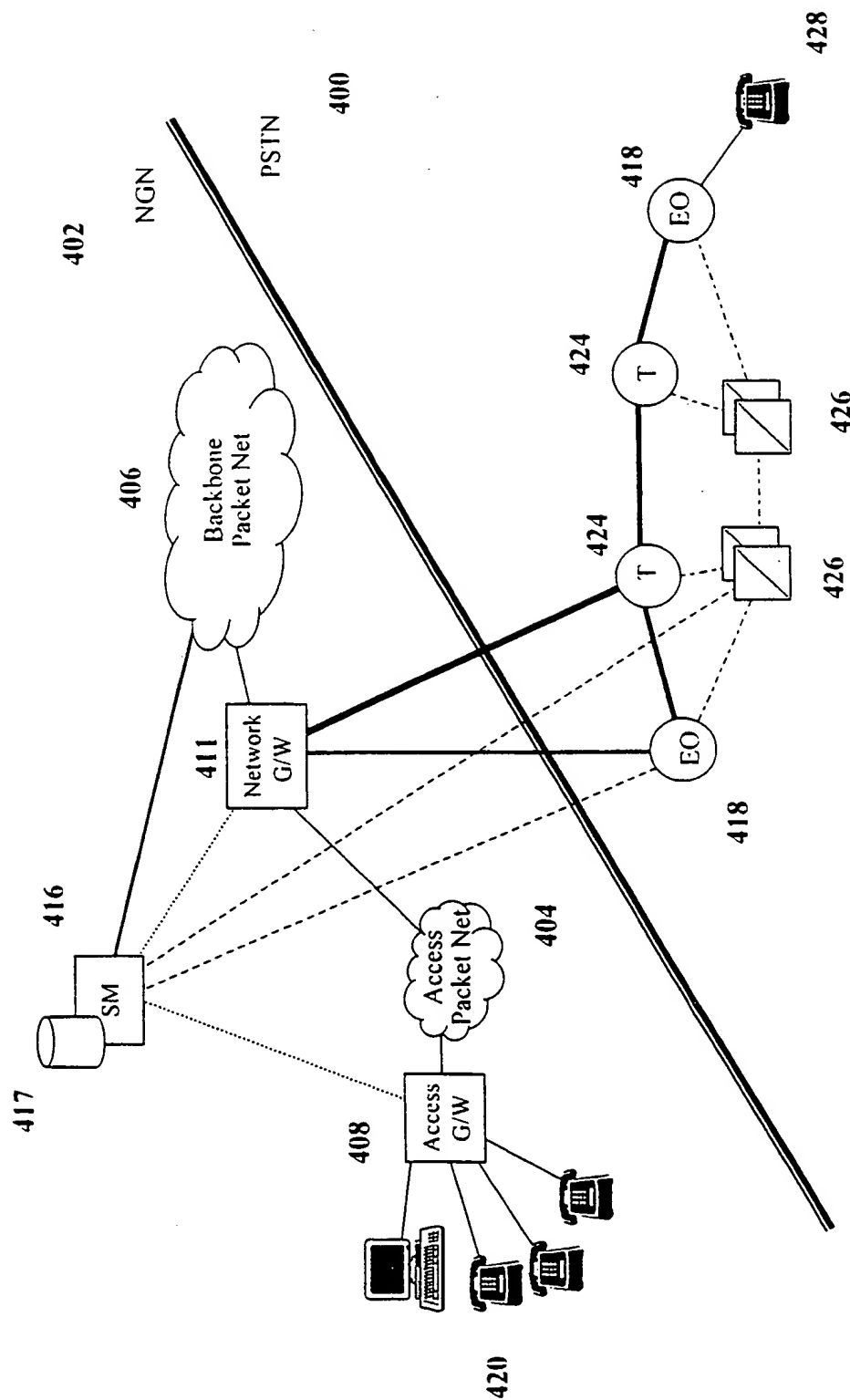


Figure 4



## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US99/29099

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : H04L 12/66; H04J 3/12; H04M 11/00

US CL : 370/352,356,522; 379/88.17.90.01,93.05

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 370/352,356,522; 379/88.17.90.01,93.05,220.

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P ----- Y,P	US 5,995,606 A (CIVANLAR ET AL) 30 NOVEMBER 1999 (30.11.99), column 3, lines 1-45 and column 4, lines 1-30, lines 53-67)	1-3 ----- 4-6, 11-14,18,19
Y,E	US 6,011,844 A (UPPALURU ET AL) 04 JANUARY 2000 (04.01.00), figures 3 & 7, column 3, lines 1-35, column 4, lines 65-67, column 5, lines 1-25, lines 48-67.	4-6, 11-14, 18,19



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
*A* document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
*E* earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
*L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*G* document member of the same patent family
*O* document referring to an oral disclosure, use, exhibition or other means	
*P* document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

09 MARCH 2000

Date of mailing of the international search report

05 APR 2000

Name and mailing address of the ISA/US  
Commissioner of Patents and Trademarks  
Box PCT  
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

PHAM, BRENDA

Telephone No. (703) 308-3900